hemorrhage, "Dr. Hunter thinks this method too often used." Since he was particularly interested in the lymphatics and the question of absorption, he was inclined to base his system of medical treatment on the assumption of "the Orifices of lymphatic Vessels being too bibulous and absorbing improper Things." For example, in regard to rabies he says, "In People bit by mad Dogs the Poison is not immediately absorbed," and he quotes his brother John's opinion that this is due to "Want of a sufficient Stimulus to excite Absorption and therefore he advises the Part to be cut out or eat away with Caustics as soon as possible." Again William says, "The Plague is supposed to be got by absorption alone from Contact," and he thought that venereal diseases were caused by absorption of "the venereal Poison by the Lymphatics of the Genitals." In general, therefore, he recommended that his students, "not use purges to carry off bad Humours, but Remedies adapted to faulty Absorption, viz., Bark and Sea-bathing."

A favorite diagnostic sign at that time was the appearance of a "buffy Coat" on a clot of a patient's blood, particularly if inflammation was present. William Hunter doubted the validity of this sign, since similar "Buff" could be seen in the case of pregnant women in health.

The ancient idea that "Nerves convey Sensation and incite to Motion by means of Animal Spirits"—in reality a corollary of the humoral theory—was still held by many in William Hunter's time, although some thought "Vibrations" were responsible, others "electric Effluvia." He, however, stated his conviction that we shall always remain ignorant of the cause of nerve activity since "it appears to be effected by Powers superior to mechanical ones." This is essentially a vitalistic conception of living phenomena, a conception which was not seriously challenged for another half century.

There are many references in the Sutro notes to surgical practice, one example of which may be cited. Although William Hunter was not certain as to the function of "nervous Ganglia," whether they were "muscles to press on the nerves and effect nervous Faculties, or an Appendage to the Brain to produce nervous Filiaments," he advised against opening them "since the Result will be Fever and Inflammation."

His ideas regarding personal hygiene are expressed in his advice to avoid tight-lacing, and his statement that "Varicocele may sometimes be occasioned by a too great Tightness of the Breeches Waistband." Again he says: "The best Method to prevent crooked Spines is to strengthen the Constitution, to this Effect nothing is equal to very cold Bathing; Children should be dipped and dried with coarse Cloth once a Day."

IN CONCLUSION

This brief survey of William Hunter's Anatomical notes discloses some of the reasons for his success as a teacher. He was far from being bound by tradition, and as an eminent physician was not afraid to recommend to his students a system of treatment based on his own observations and deductions. In spite of the fact that his basic theory does not stand up in the light of modern physiology, it was a distinct advance over the humoral theory of disease, especially in a prePasteurian era.

If we supplement the notes in the Sutro Collection by those on midwifery in the University of California Medical School, we have a very complete picture of William Hunter as a medical teacher in the latter half of the eighteenth century.

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BEAUTIFICATION AND IRRIGATION OF GOLDEN GATE PARK WITH A CLARIFIED, DISINFECTED SEWAGE EFFLUENT*

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FOREWORD.—Comparatively few persons, even among the medical profession, realize that the sanitary arts have been so far advanced in recent years that sewage—the spent water supply of the community, turbid, odorous, and heavily contaminated with fecal organisms—can be continuously transformed into clear water, free of pathogenes. Within the past two decades a type of sewage treatment, known as the activated sludge process, has been developed to an increasingly efficient and dependable state. Effluents from well-designed and properly operated, comprehensive plants of this sort are clear and of good appearance. They are readily amenable to disinfection with chlorin, in not excessive amounts, to the point where they will fulfill rigorous bacterial standards for drinking water.

Such a plant was constructed in Golden Gate Park about five years ago, and its effluent has been employed for irrigation and beautification purposes ever since.

A BRIEF REVIEW OF THE PROBLEM AND PROJECT

Golden Gate Park was wrested from the sand dunes of the Richmond-Sunset district in the west-central portion of the city of San Francisco and was made into one of the most beautiful and satisfactory recreation areas in the world.

Water has always been a relatively costly and, at times until very recently, none too abundant item among the City's public utilities. The long, dry seasons, with virtually no rainfall, compel irrigation. This becomes the more important and the quantitative demands greater if the soil is exceedingly porous and lacks humus. Such is the case in Golden Gate Park. Local water supplies from wells in the park area have been developed to the utmost, but have proved inadequate, particularly during long-continued periods of drought. A large park without lakes, brooks and waterfalls, in short without waterscapes, would be an anomaly: it would be sadly lacking in vital features. Such things, however, obviously demand an abundance of water.

* From the Department of Public Health, City and County of San Francisco.

Many years ago, before the residential districts contiguous to the westerly portion of the Park had become built up, raw sewage was used to irrigate certain areas by means of ditches. The inesthetic quality of this procedure, and the odors produced thereby, gave rise to serious complaints when people began to live in the vicinity. Eventually, despite the great need for irrigation water, the practice of employing raw sewage had to be abandoned.

In 1932 an activated sludge sewage treatment plant was constructed in the Park. Its nominal capacity was one million gallons per day. Since its completion, the chlorinated plant effluent has been employed for the irrigation and beautification of the westerly half of the Park area. Lakes, artificial brooks and waterfalls have been created and maintained; irrigation by means of ditches has been conducted when needful; and a limited amount of sprinkling by pressure pipe and hose has been possible, notably in the stadium.

The extraordinary, intimate extent to which the Park throughout its area is utilized for recreational purposes demands that the treatment-works operate without nuisance due to odors, or to noise (as from the blowers furnishing compressed air for the aeration of the sewage), and that the effluent be clear, nonputrescible, and hygienically safe. These results have been achieved with commendable uniformity.

GENERAL OUTLINE OF THE BEAUTIFICATION AND IRRIGATION WORKS

The works, which are involved in the beautification and irrigation of Golden Gate Park with treated or salvaged sewage, comprise: (1) a diversion chamber in the Lincoln Way sewer at Twentieth Avenue; (2) an influent or supply pipeline to the treatment plant; (3) an activated sludge sewage treatment plant; (4) delivery conduits to Metson, Elk and Mallard lakes; (5) an artificial brook with cascades and waterfalls leading from Metson Lake to the most southerly lake of Chain of Lakes, about two-thirds of a mile distant; (6) a pressure pipe-line, with hose irrigation, for the stadium; (7) and various temporary ditches for the occasional irrigation of dry wooded areas.

GOLDEN GATE PARK

Golden Gate Park embraces 1,013 acres, or nearly 1.6 square miles. It is approximately one-half mile wide, north and south, and three miles long, east and west. In addition, there is the panhandle, so-called, a parked area one block wide between Oak and Fell streets. Its length eastward from Stanyan Street to Baker Street is somewhat over three-fourths of a mile.

It would be impossible to describe the wealth of botanical material with which the Park has skillfully, but laboriously, been planted.

It is boasted, and rightly, that adequate provision has been made in the Park for almost every known sort of outdoor sport, except swimming. But swimming is adequately provided for at Fleishhacker pool, not far distant to the south.

There are upward of twenty-five miles of improved roadway and other miles of bridle-paths and trails. There are waterfalls and lakes with wild waterfowl in abundance. There are woods and spacious lawns, and gardens of flowers and shrubs, all containing contributions from every part of the globe.

It is said that the use of the street sweepings of the City in the early years furnished the humus necessary to plant life, and served to check the movement of sand by the wind.

The Park contains such famous institutions as the Museum of the Academy of Science, the de Young Museum, and the Steinhart Aquarium. There is the Beach Chalet and the Japanese Tea Garden. Here and there are wild animals: buffalo, elk, deer, bears, and many kinds of caged birds.

The Park owes its remarkable development to the distinguished Dr. John McLaren, its superintendent since 1887. He has just completed fifty years of service. It must be apparent that a great public recreation area such as Golden Gate Park can only be built upon intelligence and imagination, perseverance and hard work, money and material, fertilizer and water. All of these have been bestowed upon Golden Gate Park and have created a veritable paradise.

THE ACTIVATED SLUDGE SEWAGE TREATMENT PLANT

The activated sludge sewage treatment plant which, since 1932, has furnished its effluent for the beautification and irrigation of the westerly half of Golden Gate Park, comprises ten principal features, as follows: (1) a bar-screen and bypass structure; (2) a small control or diversion chamber; (3) two primary settling tanks; (4) two aeration chambers; (5) one secondary settling or clarification tank; (6) a chlorination contact chamber; (7) two covered sludge digestion tanks; (8) three sludge drying beds; (9) a chlorinator house, containing the one-ton chlorine cylinders and duplicate chlorin dosing mechanisms (chlorinators); (10) and a laboratory and blower house.

The plant is located on the south side of Middle Drive, about 1,000 feet westerly from its junction with the transverse roadway which crosses the Park from Nineteenth Avenue on the south to Twenty-fifth Avenue on the north.

The works have been well and artistically designed and constructed. Much attention has been given to the planting and landscaping of the site, so that it is rapidly becoming a really beautiful spot and an ornament rather than a disfigurement in the Park.

The treatment works were designed by Mr. Henry Elrod, Consulting Engineer, Houston, Texas. They were constructed by the McQueen Sewage Disposal Company under the personal direction of Mr. Frank McQueen. They were supervised by Mr. Earl Clements, Engineer and Assistant Park Superintendent, representing the Board of Park Commissioners.

The plant was built, for the most part, by "distressed" or relief labor. The cost is not known in detail, but with an additional primary settling tank constructed in 1936, it has been roughly estimated at about $85,000.

The annual cost of operation, exclusive of interest and depreciation, may perhaps reasonably be taken at about $7,500. If an allowance of 10 per cent be made to cover the fixed charges of interest

and depreciation, the total annual cost would become $16,000.

Since January, 1934, the plant has been most efficiently operated by Mr. Archie F. Fraser. In recent years he has been ably assisted by Mr. Bernard J. Boyle.

SOURCE, VOLUME, AND CHARACTER OF SEWAGE TREATED

The sewage treated by the plant is diverted from the Lincoln Way sewer at or near Twentieth Avenue. The area tributary to this point embraces about 1,350 acres and has a population of perhaps 15,000 persons. The per capita contribution of sewage ranges from a daily minimum rate of about 30 gallons to a daily maximum rate of about 100 gallons and averages perhaps 60 gallons per day. The tributary district contains two large hospitals and a restricted business section. Otherwise, the area is entirely residential. It is sewered by the so-called combined system.

At the present time the plant delivers about one-half million gallons of effluent per day, ranging in yield from a maximum rate of about 750,000 gallons per day during the forenoon hours to a low level of perhaps 130,000 gallons per day during the hours following midnight. The yield is limited by the available supply of sewage and of air, the blower capacity being inadequate for the full nominal plant output.

The dry weather flow of sewage is strong or concentrated. On Mondays and Tuesdays, particularly, it contains relatively large amounts of grease and soapy material. The average total suspended solids are in the neighborhood of 400 parts per million. The biochemical oxygen demand averages about 370 parts per million.

CHARACTER OF THE PLANT EFFLUENT

The effluent of the plant normally contains about twenty parts per million of total suspended solids, and its average biochemical oxygen demand is fifteen parts per million. The plant performance, as related to these two characteristics, has been steadily improved since the works were placed in operation. It would probably now be difficult to find anywhere an activated sludge effluent of generally better appearance and quality than that consistently produced at the Golden Gate Park plant. The plant operators should be highly commended for their excellent achievements.

The Department of Public Health of the City and County of San Francisco has assumed a degree of responsibility for the hygienic character of the plant effluent. From time to time since February 17, 1933, bacteriological samples of the chlorinated plant effluent have been collected by an inspector of the Department and have been examined in its laboratory. The visits of the inspector are irregular and unannounced. A total of 173 samples had been collected up to August 12, 1937. Total counts at 37 degrees centigrade have been made and the presumptive presence of B. coli determined in various dilutions. It has been the practice to inoculate two tubes each with 10, 1, 0.1, 0.01, and 0.001 cubic centimeters of every sample.

The results have been exceedingly good, especially during the past two years. No single sample collected in 1937 showed the presence of B. coli in any amount examined, not even in 10 cubic centimeters. During 1936, five per cent of the samples showed the presumptive presence of B. coli in one cubic centimeter and 12 per cent in 10 cubic centimeters.

The water supply of the Park, other than the sewage effluent in question, is derived from the ground. Stow Lake and other lakes supplied by ground water are generally heavily infested with algae, and are normally very green. The growth of algae is stimulated by the nitrogen in the plant effluent, so that the lakes supplied from this source are even more deeply tinged with green and are commonly turbid on this account.

USE OF PLANT EFFLUENT IN THE PARK

The effluent under discussion is being used to supply Metson Lake and the Chain of Lakes in combination with water released from Stow Lake. Elk Lake was created in 1936 and Mallard Lake in 1937. Both are supplied wholly with plant effluent.

From Metson Lake to South Lake, of the Chain of Lakes, as already indicated, an artificial brook about two-thirds of a mile in length, with numerous cascades and waterfalls, has been constructed to convey the combined flow of effluent, and of water from Stow Lake. The stadium, which can boast of one of the finest polo fields in existence, is irrigated with plant effluent conveyed in a pipe-line under pressure and applied by means of a hose, with and without sprinklers. At times and places, temporary irrigation ditches, with laterals, are employed to irrigate dry areas.

The sewage effluent is thus employed both for beautification and irrigation in the western half of Golden Gate Park, and it is difficult to separate one use from the other or determine which is the more significant.

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MEDICAL HISTORY REPEATS ITSELF

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400 B. C.

"For should you begin by discussing fees, you will suggest to the patient either that you will go away and leave him if no agreement be reached, or you will neglect him and not prescribe any immediate treatment. So one must not be anxious about fixing a fee. For I consider such a worry to be harmful to a troubled patient, particularly if the disease be acute. . . . Therefore, it is better to reproach a patient you have saved than to exhort money from those who are at death's door."

1938 A. D.

"When a long course of treatment is indicated, naming a lump-sum fee is often the best possible way to scare off the patient. Not that the amount the doctor asks is unreasonable, but the person who is going to pay it may have to be sold on the idea gradually. Many patients who shy away in alarm when you mention a charge of two or three hundred dollars can pay it, and will—if properly conditioned."

THE science of medicine had a prolonged infancy and youth, lasting from Aesculapius to Pasteur, and then grew more rapidly in fifty years than it had in five thousand. The modern scientist